Progress Energy

January 26, 2009

SERIAL: BSEP 09-0007 10 CFR 50.73

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555-0001

Subject: Brunswick Steam Electric Plant, Unit No. 1
Docket No. 50-325/License No. DPR-71
Licensee Event Report 1-2008-007

Ladies and Gentlemen:

In accordance with the Code of Federal Regulations, Title 10, Part 50.73, Carolina Power & Light Company, now doing business as Progress Energy Carolinas, Inc., submits the enclosed Licensee Event Report (LER). This report fulfills the requirement for a written report within sixty (60) days of a reportable occurrence.

Please refer any questions regarding this submittal to Mr. Gene Atkinson, Supervisor - Licensing/Regulatory Programs, at (910) 457-2056.

Sincerely,

Edward L. Wills, Jr.
Plant General Manager
Brunswick Steam Electric Plant

MAT/mat

Enclosure:

Licensee Event Report

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Brunswick Nuclear Plant
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JE22
NRR

cc (with enclosure):

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NRC FORM 366 (9-2007) U.S. NUCLEAR REGULATORY COMMISSION	APPROVED BY OMB: NO. 3150-0104 EXPIRES: 08/31/2010
LICENSEE EVENT REPORT (LER) (See reverse for required number of digits/characters for each block)	Estimated burden per response to comply with this mandatory collection request: 80 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the Records and FOIA/Privacy Service Branch (T-5 F52), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to infocollects@nrc.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202, (3150-0104), Office of Management and Budget, Washington, DC 20503. If a means used to impose an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

1. FACILITY NAME	2. DOCKET NUMBER	3. PAGE
Brunswick Steam Electric Plant (BSEP), Unit 1	05000325	1 of 5

4. TITLE
Automatic Reactor Scram due to Electro-Hydraulic Control System Failure

5. EVENT DATE			6. LER NUMBER			7. REPORT DATE			8. OTHER FACILITIES INVOLVED	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REV NO.	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER 05000
11	26	2008	2008	007	00	01	26	2009	FACILITY NAME	DOCKET NUMBER 05000

9. OPERATING MODE	1
10. POWER LEVEL	022

11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: *(Check all that apply)*

☐ 20.2201(b)	☐ 20.2203(a)(3)(i)	☐ 50.73(a)(2)(i)(C)	☐ 50.73(a)(2)(vii)
☐ 20.2201(d)	☐ 20.2203(a)(3)(ii)	☐ 50.73(a)(2)(ii)(A)	☐ 50.73(a)(2)(viii)(A)
☐ 20.2203(a)(1)	☐ 20.2203(a)(4)	☐ 50.73(a)(2)(ii)(B)	☐ 50.73(a)(2)(viii)(B)
☐ 20.2203(a)(2)(i)	☐ 50.36(c)(1)(i)(A)	☐ 50.73(a)(2)(iii)	☐ 50.73(a)(2)(ix)(A)
☐ 20.2203(a)(2)(ii)	☐ 50.36(c)(1)(ii)(A)	☒ 50.73(a)(2)(iv)(A)	☐ 50.73(a)(2)(x)
☐ 20.2203(a)(2)(iii)	☐ 50.36(c)(2)	☐ 50.73(a)(2)(v)(A)	☐ 73.71(a)(4)
☐ 20.2203(a)(2)(iv)	☐ 50.46(a)(3)(ii)	☐ 50.73(a)(2)(v)(B)	☐ 73.71(a)(5)
☐ 20.2203(a)(2)(v)	☐ 50.73(a)(2)(i)(A)	☐ 50.73(a)(2)(v)(C)	☐ OTHER
☐ 20.2203(a)(2)(vi)	☐ 50.73(a)(2)(i)(B)	☐ 50.73(a)(2)(v)(D)	Specify in Abstract below or in NRC Form 366A

12. LICENSEE CONTACT FOR THIS LER

FACILITY NAME	TELEPHONE NUMBER (Include Area Code)
Mark Turkal, Lead Engineer - Licensing	(910) 457-3066

13. COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT

CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX

14. SUPPLEMENTAL REPORT EXPECTED	15. EXPECTED SUBMISSION DATE	MONTH	DAY	YEAR
☐ YES *(If yes, complete 15. EXPECTED SUBMISSION DATE)* ☒ NO				

ABSTRACT *(Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines)*

On November 26, 2008, at approximately 1200 hours Eastern Standard Time (EST), Unit 1 experienced a primary containment Group 1 isolation which resulted in an automatic actuation of the Reactor Protection system. The Pressure-Load Gate Amplifier (PLGA) circuit board (A58), in the Electro-Hydraulic Control system, operated erroneously which caused a sensed Main Steam Line low pressure on Main Steam Line Low Pressure instruments B21-PT-N015A through D. The sensed low pressure while in Mode 1 resulted in the Group 1 isolation. Following the scram, an expected reactor vessel coolant level shrink occurred. As a result of the low water level, primary containment Groups 2 and 6 isolation signals were received. All required isolations occurred as a result of the reactor low water level isolation signals. All control rods fully inserted on the scram and safety-related systems responded as designed. The Reactor Core Isolation Cooling System was manually started to restore reactor water level to the normal band.

The erroneous operation of the PLGA circuit board was due to loose connection(s) within the blade / blade receptacle connection. The root cause of the loose connection was that the key slot in circuit board A58 was not squared at the bottom mating surface. Resin at the bottom mating surface, present since original manufacturing of the circuit board, prevented full seating with the terminal receptacle. Corrective actions to prevent reoccurrence include: (1) visual verification of Unit 1 and Unit 2 EHC circuit board engagement at the next opportunity and (2) procedural enhancements to ensure circuit board engagement after maintenance work is performed.

NARRATIVE

Energy Industry Identification System (EIIS) codes are identified in the text as [XX].

<u>Introduction</u>

Initial Conditions

At the time of the event, Unit 1 was in Mode 1, operating at approximately 22 percent of Rated Thermal Power (RTP). All required safety related systems were operable.

Reportability Criteria

This event resulted in an automatic Reactor Protection system (RPS) [JC] actuation, manual initiation of the Reactor Core Isolation Cooling (RCIC) system [BN], and various Primary Containment Isolation system (PCIS) [JM] initiations. As such, this event is being reported in accordance with 10 CFR 50.73(a)(2)(iv)(A) as an event that resulted in valid actuation of systems listed in 10 CFR 50.73(a)(2)(iv)(B). The NRC was initially notified of this event on November 26, 2008 (i.e., Event Number 44685).

<u>Event Description</u>

On November 26, 2008, Unit 1 was in Mode 1 and in the process of startup following a planned maintenance outage. At approximately 1200 hours Eastern Standard Time (EST), while synchronizing the Main Generator [TB] to the grid, Unit 1 experienced a primary containment Group 1 (i.e., Main Steam Isolation Valves (MSIVs)) isolation which resulted in an automatic RPS actuation. At the time of the event, reactor power was approximately 22 percent of RTP. The MSIVs closed as expected. All control rods fully inserted on the scram and safety-related systems responded as designed.

Immediately following the scram, an expected reactor vessel coolant level shrink occurred and reactor water level reached the Low Level 1 (LL1) setpoint. The LL1 signal caused a Group 2 (i.e., Drywell Equipment and Floor Drain, Traversing In-Core Probe, Residual Heat Removal (RHR) Discharge to Radwaste, and RHR Process Sample Isolation Valves) and a Group 6 (i.e., Containment Atmosphere Control/Dilution, Containment Atmosphere Monitoring, and Post Accident Sampling System Isolation Valves) isolation. All LL1 actuations occurred as designed. The RCIC system was manually started to restore reactor water level to the normal band.

The MSIVs were re-opened at approximately 1511 hours on November 26, 2008. Subsequently, it was determined that valve 1-MS-V28, "Main Steam Supply - Moisture Separator Reheater, Reactor Feed Pump, Steam Jet Air Ejector," would not operate. Trouble shooting activities found that the valve was thermally bound. Failure of the valve would have prevented the ability to use the Reactor Feedwater pumps (RFPs) [SK] as a high pressure water source during transient conditions, if required. However, in this case, it did not impact Operator response to the event.

NARRATIVE

Event Cause

An initial investigation was performed to support startup of Unit 1. This investigation determined that the Pressure-Load Gate Amplifier (PLGA) circuit board (A58), in the Electro-Hydraulic Control (EHC) system [TG], was found to have an intermittent connection. Technicians found that the circuit board voltages varied when flexing the circuit board (i.e., pushing it in) indicating that there were loose connection(s) within the A58 blade / blade receptacle connection. Trends of the event confirmed that the PLGA did not limit the Control Valve Amplifier's (CVA) output to the control valve servos. As a result, the turbine control valves opened too far, causing Main Steam Line pressure to drop and a Group 1 isolation. The Group 1 isolation, caused by the erroneous operation of circuit board A58, was the direct cause of the November 26, 2008, Unit 1 scram.

The root cause of the erroneous operation of circuit board A58 is that the key slot in circuit board A58 was not squared at the bottom mating surface. This circuit board is original plant equipment. Resin at the bottom mating surface, present since original manufacturing of the circuit board, prevented full seating with the terminal receptacle. Since this circuit board has operated since original plant startup without causing a scram, this condition alone would not result in erroneous operation of circuit board A58. However, 100 percent engagement of the blades would have prevented the November 26, 2008, scram from occurring.

Two contributing causes were identified. First, spring cyclic fatigue associated with the blade receptacles within the EHC circuit board terminals further reduced blade engagement. Circuit board A58 is removed and inserted from the cabinet frequently during a refueling outage in support of calibration activities. It is estimated that this occurs ten or more times an outage. Frequent cycling of the spring will cause fatigue and relaxation. Spring relaxation will adversely affect the circuit board A58 blade / blade receptacle connection. However, it was determined that spring relaxation alone would not have caused the scram. With fully failed springs, there is still adequate contact with 100 percent insertion of the blade.

The second contributing cause was trouble shooting activities associated with circuit board A52 which resulted in further loosening of the connections associated with circuit board A58. Trouble shooting activities were performed on circuit board A52 during the maintenance outage. There is previous Brunswick specific operating experience (i.e., LER 2-2003-03, Nuclear Condition Report (NCR) 89705) which documents a Unit 2 scram on April 4, 2003, due to the Steam Line Resonance Compensator (SLRC) circuit board not being fully seated. The root cause evaluation for NCR 89705 determined that flexing of the slot or connector associated with circuit boards can cause loosening of surrounding circuit boards. Since the A58 circuit board is relatively close to the A52 circuit board (i.e., 5 slots, 3 circuit boards separation), it is probable that the trouble shooting of circuit board A52 negatively affected the A58 blade / blade receptacle connections.

Safety Assessment

The safety significance of this event is considered to be minimal. All required safety-related systems responded to the transient as designed. The consequences of this low power transient on the fuel and vessel

NARRATIVE

Safety Assessment (continued)

were minimal. The analyses in Chapter 15 of the Updated Final Safety Analysis Report fully bound this event.

Corrective Actions

The A58 circuit board was replaced to support Unit 1 startup.

The following corrective actions to prevent recurrence have been identified.

- The Unit 1 and Unit 2 circuit board connections within the EHC cabinets will be visually inspected to ensure surface to surface engagement between the blade and receptacle housings, and actions will be taken, as necessary, to achieve surface to surface engagement. This action will be completed during the next Unit 1 and 2 outages that result in the unit being taken to Mode 4, but no later than during the spring 2009 Unit 2 refueling outage (i.e., B219R1) and the spring 2010 Unit 1 refueling outage (i.e., B118R1).

- Procedure 0SMP-EHC001, "Electro Hydraulic Controls System Alignment," was revised to require visual confirmation of 100 percent engagement between the blade and receptacle housings for the EHC circuit boards. This action was completed on January 14, 2009, to support the 2009 Unit 2 refueling outage

- A methodology will be established to ensure visual confirmation of 100 percent engagement between the blade and receptacle housings for the EHC circuit boards after work or trouble shooting not controlled by 0SMP-EHC001. This action will be completed by March 16, 2009.

Additional corrective actions include the following.

- Appropriate Unit 1 and Unit 2 EHC blade receptacles, determined by an evaluation of the potential consequences of failure and susceptibility to fatigue based on typical outage activities, will be replaced during the spring 2010 Unit 1 refueling outage (i.e., B118R1) and the spring 2011 Unit 2 refueling outage (i.e., B220R1).

- A means to ensure positive seating of the EHC circuit boards (e.g., harness) will be implemented during the spring 2010 Unit 1 refueling outage (i.e., B118R1) and the spring 2011 Unit 2 refueling outage (i.e., B220R1).

Previous Similar Events

A review of LERs and corrective action program condition reports identified the following similar event.

NARRATIVE

Previous Similar Events (continued)

- LER 2-2003-003, dated June 2, 2003, documents a Unit 2 scram on April 4, 2003, due to the Steam Line Resonance Compensator (SLRC) circuit board not being fully seated. The root cause evaluation for NCR 89705 determined that flexing of the slot or connector associated with circuit boards can cause loosening of surrounding circuit boards. The corrective actions for the event described in LER 2-2003-003 implemented a change to Maintenance procedure 0SPP-EHC001, "Electro Hydraulic Control Systems Alignment," to include new details for verifying proper EHC card engagement (i.e., firmly seat all circuit boards in the EHC cabinet by pushing on the boards).

The trouble shooting activities that were performed during the Unit 1 maintenance outage were completed in accordance with work orders and not via plant procedure 0SMP-EHC001 (i.e., formerly 0SPP-EHC001) which is for an integrated checkout of the EHC system normally performed during a refueling outage and not intended for specific trouble shooting activities. As such, the EHC cards were not verified to be properly engaged after the trouble shooting activities associated with circuit board A52, though it is not likely that such verification would have prevented the November 26, 2008, Unit 1 scram. Trouble shooting activities associated with circuit board A58 demonstrated that: (1) the inadequate connection could be readily repeated with minimal pull on the A58 circuit board, and (2) no actual inward movement was observed when the A58 circuit board was pushed. Given the condition of the key slot (i.e., root cause of the Unit 1 scram) and the suspected spring fatigue, unless circuit board A58 was the last circuit board to be verified it is likely that subsequent seating verification manipulation of adjacent circuit boards would have negated any benefit derived from verifying circuit board A58 was seated.

Commitments

No regulatory commitments are contained in this report.